

What is claimed is:

1. A power supply for an implantable cardioverter-defibrillator for subcutaneous positioning between the third rib and the twelfth rib and for providing  
5 cardioversion/defibrillation energy to the heart, the power supply comprising:

a capacitor subsystem for storing the cardioversion/defibrillation energy for delivery to the patient's heart; and

10 a battery subsystem electrically coupled to the capacitor subsystem for providing electrical energy to the capacitor subsystem.

15 2. The power supply of claim 1, wherein the battery subsystem comprises two or more battery cells.

3. The power supply of claim 2, wherein the battery subsystem comprises three or more battery cells.

20 4. The power supply of claim 3, wherein the battery subsystem comprises four or more battery cells.

5. The power supply of claim 1, wherein the capacitor subsystem comprises two or more capacitors.

6. The power supply of claim 5, wherein the capacitor subsystem comprises three or more capacitors.

5 7. The power supply of claim 6, wherein the capacitor subsystem comprises four or more capacitors.

8. The power supply of claim 7, wherein the capacitor subsystem comprises five or more capacitors.

10 9. The power supply of claim 8, wherein the capacitor subsystem comprises six or more capacitors.

15 10. The power supply of claim 1, wherein the cardioversion/defibrillation energy is approximately 40 to approximately 210 joules.

20 11. The power supply of claim 10, wherein the cardioversion/defibrillation energy is approximately 40 to approximately 60 joules.

12. The power supply of claim 10, wherein the cardioversion/defibrillation energy is approximately 60 to approximately 85 joules.

13. The power supply of claim 10, wherein the cardioversion/defibrillation energy is approximately 85 to approximately 115 joules.

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14. The power supply of claim 10, wherein the cardioversion/defibrillation energy is approximately 115 to approximately 140 joules.

10 15. The power supply of claim 10, wherein the cardioversion/defibrillation energy is approximately 140 to approximately 160 joules.

15 16. The power supply of claim 10, wherein the cardioversion/defibrillation energy is approximately 160 to approximately 210 joules.

17. The power supply of claim 1, wherein the battery subsystem comprises at least one battery cell(s).

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18. The power supply of claim 17, wherein the at least one battery cell(s) comprise LiSVO battery cell(s).

19. The power supply of claim 1, wherein the capacitor subsystem has an effective capacitance of approximately 50 microfarads to approximately 200 microfarads.

5 20. The power supply of claim 19, wherein the capacitor subsystem has an effective capacitance of approximately 70 microfarads.

10 21. The power supply of claim 19, wherein the capacitor subsystem has an effective capacitance of approximately 100 microfarads.

15 22. The power supply of claim 1, wherein the implantable cardioverter-defibrillator is less than approximately 100 cubic centimeters in volume.

20 23. The power supply of claim 22, wherein the implantable cardioverter-defibrillator is less than approximately 50 cubic centimeters in volume.

24. The power supply of claim 1, wherein the cardioversion/defibrillation energy has a peak voltage of approximately 700 volts to approximately 3150 volts.

25. The power supply of claim 24, wherein the cardioversion/defibrillation energy has a peak voltage of approximately 700 volts to approximately 1050 volts.

5 26. The power supply of claim 24, wherein the cardioversion/defibrillation energy has a peak voltage of approximately 1050 volts to approximately 1400 volts.

10 27. The power supply of claim 24, wherein the cardioversion/defibrillation energy has a peak voltage of approximately 1400 volts to approximately 1750 volts.

15 28. The power supply of claim 24, wherein the cardioversion/defibrillation energy has a peak voltage of approximately 1750 volts to approximately 2100 volts.

20 29. The power supply of claim 24, wherein the cardioversion/defibrillation energy has a peak voltage of approximately 2100 volts to approximately 2450 volts.

30. The power supply of claim 24, wherein the cardioversion/defibrillation energy has a peak voltage of approximately 2450 volts to approximately 2800 volts.

31. The power supply of claim 24, wherein the cardioversion/defibrillation energy has a peak voltage of approximately 2800 volts to approximately 3150 volts.

5 32. A power supply for an implantable cardioverter-defibrillator for subcutaneous positioning outside the ribcage and between the third rib and the twelfth rib within a patient and using a lead system that does not directly contact the patient's heart or reside in the intrathoracic blood vessels,  
10 and for providing cardioversion/defibrillation energy to the heart, the power supply comprising:

a capacitor subsystem for storing the cardioversion/defibrillation energy for delivery to the patient's heart; and

15 a battery subsystem electrically coupled to the capacitor subsystem for providing electrical energy to the capacitor subsystem.

20 33. The power supply of claim 32, wherein the battery subsystem comprises two or more battery cells.

34. The power supply of claim 33, wherein the battery subsystem comprises three or more battery cells.

35. The power supply of claim 34, wherein the battery subsystem comprises four or more battery cells.

36. The power supply of claim 32, wherein the capacitor subsystem comprises two or more capacitors.

37. The power supply of claim 36, wherein the capacitor subsystem comprises three or more capacitors.

38. The power supply of claim 37, wherein the capacitor subsystem comprises four or more capacitors.

39. The power supply of claim 38, wherein the capacitor subsystem comprises five or more capacitors.

40. The power supply of claim 39, wherein the capacitor subsystem comprises six or more capacitors.

41. The power supply of claim 32, wherein the cardioversion/defibrillation energy is approximately 40 to approximately 210 joules.

42. The power supply of claim 41, wherein the cardioversion/defibrillation energy is approximately 40 to approximately 60 joules.

5 43. The power supply of claim 41, wherein the cardioversion/defibrillation energy is approximately 60 to approximately 85 joules.

10 44. The power supply of claim 41, wherein the cardioversion/defibrillation energy is approximately 85 to approximately 115 joules.

15 45. The power supply of claim 41, wherein the cardioversion/defibrillation energy of approximately 115 to approximately 140 joules.

20 46. The power supply of claim 41, wherein the cardioversion/defibrillation energy is approximately 140 to approximately 160 joules.

47. The power supply of claim 41, wherein the cardioversion/defibrillation energy is approximately 160 to approximately 210 joules.

48. The power supply of claim 32, wherein the battery subsystem comprises at least one battery cell(s).

49. The power supply of claim 48, wherein the at least one  
5 battery cell(s) comprise LiSVO battery cell(s).

50. The power supply of claim 32, wherein the capacitor subsystem has an effective capacitance of approximately 50 microfarads to approximately 200 microfarads.

51. The power supply of claim 50, wherein the capacitor subsystem has an effective capacitance of approximately 70 microfarads.

52. The power supply of claim 50, wherein the capacitor subsystem has an effective capacitance of approximately 100 microfarads.

53. The power supply of claim 32, wherein the implantable  
20 cardioverter-defibrillator is less than approximately 100 cubic centimeters in volume.

54. The power supply of claim 52, wherein the implantable cardioverter-defibrillator is less than approximately 50 cubic centimeters in volume.

5 55. The power supply of claim 32, wherein the cardioversion/defibrillation energy has a peak voltage of approximately 700 volts to approximately 3150 volts.

10 56. The power supply of claim 55, wherein the cardioversion/defibrillation energy has a peak voltage of approximately 700 volts to approximately 1050 volts.

15 57. The power supply of claim 55, wherein the cardioversion/defibrillation energy has a peak voltage of approximately 1050 volts to approximately 1400 volts.

20 58. The power supply of claim 55, wherein the cardioversion/defibrillation energy has a peak voltage of approximately 1400 volts to approximately 1750 volts.

59. The power supply of claim 55, wherein the cardioversion/defibrillation energy has a peak voltage of approximately 1750 volts to approximately 2100 volts.

60. The power supply of claim 55, wherein the cardioversion/defibrillation energy has a peak voltage of approximately 2100 volts to approximately 2450 volts.

5 61. The power supply of claim 55, wherein the cardioversion/defibrillation energy has a peak voltage of approximately 2450 volts to approximately 2800 volts.

10 62. The power supply of claim 55, wherein the cardioversion/defibrillation energy has a peak voltage of approximately 2800 volts to approximately 3150 volts.

15 63. A voltage output system for an implantable heart stimulator for subcutaneous positioning between the third rib and the twelfth rib within a patient and employing a lead system that does not directly contact the patient's heart or reside in the intrathorasic blood vessels, comprising:

20 an energy storage system for storing electrical energy to generate an electrical stimulation pulse for delivery to the patient's heart; and

an energy source system operably connected to the energy storage system for providing the electrical energy to the energy storage system.

64. The voltage output system of claim 63, wherein the energy source system comprises two or more battery cells.

5 65. The voltage output system of claim 64, wherein the energy source system comprises three or more battery cells.

66. The voltage output system of claim 65, wherein the energy source system comprises four or more battery cells.

10 67. The voltage output system of claim 63, wherein the energy storage system comprises two or more capacitors.

15 68. The voltage output system of claim 67, wherein the energy storage system comprises three or more capacitors.

69. The voltage output system of claim 68, wherein the energy storage system comprises four or more capacitors.

20 70. The voltage output system of claim 69, wherein the energy storage system comprises five or more capacitors.

71. The voltage output system of claim 70, wherein the energy storage system comprises six or more capacitors.

72. The voltage output system of claim 63, wherein the electrical stimulation pulse is approximately 40 to approximately 210 joules.

5 73. The voltage output system of claim 72, wherein the electrical stimulation pulse is approximately 40 to approximately 60 joules.

10 74. The voltage output system of claim 72, wherein the electrical stimulation pulse is approximately 60 to approximately 85 joules.

15 75. The voltage output system of claim 72, wherein the electrical stimulation pulse is approximately 85 to approximately 115 joules.

20 76. The voltage output system of claim 72, wherein the electrical stimulation pulse is approximately 115 to approximately 140 joules.

77. The voltage output system of claim 72, wherein the electrical stimulation pulse is approximately 140 to approximately 160 joules.

78. The voltage output system of claim 72, wherein the electrical stimulation pulse is approximately 160 to approximately 210 joules.

5 79. The voltage output system of claim 63, wherein the energy source system comprises at least one battery cell(s).

80. The voltage output system of claim 79, wherein the at least one battery cell(s) comprise LiSVO battery cell(s).

10 81. The voltage output system of claim 63, wherein the energy storage system has an effective capacitance of approximately 50 microfarads to approximately 200 microfarads.

15 82. The power supply of claim 80, wherein the energy storage system has an effective capacitance of approximately 70 microfarads.

20 83. The voltage output system of claim 80, wherein the energy storage system has an effective capacitance of approximately 100 microfarads.

84. The voltage output system of claim 63, wherein the implantable heart stimulator is less than approximately 100 cubic centimeters in volume.

5 85. The voltage output system of claim 83, wherein the implantable heart stimulator is less than approximately 50 cubic centimeters in volume.

10 86. The voltage output system of claim 63, wherein the electrical stimulation pulses comprise cardioversion/defibrillator pulses.

15 87. The voltage output system of claim 63, wherein the electrical stimulation pulses comprise pacing pulses.

88. The voltage output system of claim 63, wherein the electrical stimulation pulse has a peak voltage of approximately 700 volts to approximately 3150 volts.

20 89. The voltage output system of claim 88, wherein the electrical stimulation pulse has a peak voltage of approximately 700 volts to approximately 1050 volts.

90. The voltage output system of claim 88, wherein the electrical stimulation pulse has a peak voltage of approximately 1050 volts to approximately 1400 volts.

5 91. The voltage output system of claim 88, wherein the electrical stimulation pulse has a peak voltage of approximately 1400 volts to approximately 1750 volts.

10 92. The voltage output system of claim 88, wherein the electrical stimulation pulse has a peak voltage of approximately 1750 volts to approximately 2100 volts.

15 93. The voltage output system of claim 88, wherein the electrical stimulation pulse has a peak voltage of approximately 2100 volts to approximately 2450 volts.

20 94. The voltage output system of claim 88, wherein the electrical stimulation pulse has a peak voltage of approximately 2450 volts to approximately 2800 volts.

95. The voltage output system of claim 88, wherein the electrical stimulation pulse has a peak voltage of approximately 2800 volts to approximately 3150 volts.

96. An implantable cardioverter-defibrillator for subcutaneous positioning outside the ribcage and between the third rib and the twelfth rib within a patient, the implantable cardioverter-defibrillator comprising:

5 a housing having an electrically conductive surface on an outer surface of the housing;

a lead assembly electrically coupled to the housing and having an electrode, wherein the lead assembly does not directly contact the patient's heart or reside in the intrathorasic blood vessels;

10 a capacitor subsystem located within the housing and electrically coupled to the electrically conductive surface and the electrode for storing cardioversion/defibrillation energy and for delivering the cardioversion/defibrillation energy to the patient's heart through the electrically conductive surface and the electrode; and

15 a battery subsystem electrically coupled to the capacitor subsystem for providing the cardioversion/defibrillation energy to the capacitor subsystem.

20 97. The implantable cardioverter-defibrillator of claim 96, wherein the battery subsystem comprises two or more battery cells.

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98. The implantable cardioverter-defibrillator of claim 97, wherein the battery subsystem comprises three or more battery cells.

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99. The implantable cardioverter-defibrillator of claim 98, wherein the battery subsystem comprises four or more battery cells.

100. The implantable cardioverter-defibrillator of claim 96, wherein the capacitor subsystem comprises two or more capacitors.

101. The implantable cardioverter-defibrillator of claim 100, wherein the capacitor subsystem comprises three or more capacitors.

102. The implantable cardioverter-defibrillator of claim 101, wherein the capacitor subsystem comprises four or more capacitors.

103. The implantable cardioverter-defibrillator of claim 102, wherein the capacitor subsystem comprises five or more capacitors.

104. The implantable cardioverter-defibrillator of claim 103, wherein the capacitor subsystem comprises six or more capacitors.

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105. The implantable cardioverter-defibrillator of claim 96, wherein the cardioversion/defibrillation energy is approximately 40 to approximately 210 joules.

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106. The implantable cardioverter-defibrillator of claim 105, wherein the cardioversion/defibrillation energy is approximately 40 to approximately 60 joules.

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107. The implantable cardioverter-defibrillator of claim 105, wherein the cardioversion/defibrillation energy is approximately 60 to approximately 85 joules.

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108. The implantable cardioverter-defibrillator of claim 105, wherein the cardioversion/defibrillation energy is approximately 85 to approximately 115 joules.

109. The implantable cardioverter-defibrillator of claim 105, wherein the cardioversion/defibrillation energy of approximately 115 to approximately 140 joules.

110. The implantable cardioverter-defibrillator of claim 105, wherein the cardioversion/defibrillation energy is approximately 140 to approximately 160 joules.

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111. The implantable cardioverter-defibrillator of claim 105, wherein the cardioversion/defibrillation energy is approximately 160 to approximately 210 joules.

112. The implantable cardioverter-defibrillator of claim 96, wherein the battery subsystem comprises at least one battery cell(s).

113. The implantable cardioverter-defibrillator of claim 112, wherein the at least one battery cell(s) comprise LiSVO battery cell(s).

114. The implantable cardioverter-defibrillator of claim 96, wherein the capacitor subsystem has an effective capacitance of approximately 50 microfarads to approximately 200 microfarads.

115. The implantable cardioverter-defibrillator of claim 114, wherein the capacitor subsystem has an effective capacitance of approximately 70 microfarads.

5 116. The implantable cardioverter-defibrillator of claim 114, wherein the capacitor subsystem has an effective capacitance of approximately 100 microfarads.

10 117. The implantable cardioverter-defibrillator of claim 96, wherein the implantable cardioverter-defibrillator is less than approximately 100 cubic centimeters in volume.

15 118. The implantable cardioverter-defibrillator of claim 117, wherein the implantable cardioverter-defibrillator is less than approximately 50 cubic centimeters in volume.

20 119. The implantable cardioverter-defibrillator of claim 96, wherein the cardioversion/defibrillation energy has a peak voltage of approximately 700 volts to approximately 3150 volts.

120. The implantable cardioverter-defibrillator of claim 119, wherein the cardioversion/defibrillation energy has a peak voltage of approximately 700 volts to approximately 1050 volts.

121. The implantable cardioverter-defibrillator of claim 119, wherein the cardioversion/defibrillation energy has a peak voltage of approximately 1050 volts to approximately 1400 volts.

5 122. The implantable cardioverter-defibrillator of claim 119, wherein the cardioversion/defibrillation energy has a peak voltage of approximately 1400 volts to approximately 1750 volts.

10 123. The implantable cardioverter-defibrillator of claim 119, wherein the cardioversion/defibrillation energy has a peak voltage of approximately 1750 volts to approximately 2100 volts.

15 124. The implantable cardioverter-defibrillator of claim 119, wherein the cardioversion/defibrillation energy has a peak voltage of approximately 2100 volts to approximately 2450 volts.

20 125. The implantable cardioverter-defibrillator of claim 119, wherein the cardioversion/defibrillation energy has a peak voltage of approximately 2450 volts to approximately 2800 volts.

126. The implantable cardioverter-defibrillator of claim 119, wherein the cardioversion/defibrillation energy has a peak voltage of approximately 2800 volts to approximately 3150 volts.

127. A method of supplying power for an implantable cardioverter-defibrillator for subcutaneous positioning outside the ribcage and between the third rib and the twelfth rib within a patient and using a lead system that does not directly contact  
5 the patient's heart or reside in the intrathorasic blood vessels, the method comprising:

generating cardioversion/defibrillation energy;  
storing the cardioversion/defibrillation energy; and  
delivering the cardioversion/defibrillation energy to  
10 the patient's heart.

128. The method of claim 127, wherein step of generating cardioversion/defibrillation energy further comprises generating the cardioversion/defibrillation energy from an energy source  
15 system.

129. The method of claim 127, wherein step of storing the cardioversion/defibrillation energy further comprises storing the cardioversion/defibrillation energy in an energy storage  
20 system.

130. The method of claim 128, wherein the energy source system comprises two or more battery cells.

131. The method of claim 130, wherein the energy source system comprises three or more battery cells.

132. The method of claim 131, wherein the energy source  
5 system comprises four or more battery cells.

133. The method of claim 132, wherein the energy storage system comprises two or more capacitors.

134. The method of claim 133, wherein the energy storage  
10 system comprises three or more capacitors.

135. The method of claim 134, wherein the energy storage  
15 system comprises four or more capacitors.

136. The method of claim 135, wherein the energy storage system comprises five or more capacitors.

137. The method of claim 136, wherein the energy storage  
20 system comprises six or more capacitors.

138. The method of claim 127, wherein the cardioversion/defibrillation energy is approximately 40 to approximately 210 joules.

139. The method of claim 138, wherein the cardioversion/defibrillation energy is approximately 40 to approximately 60 joules.

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140. The method of claim 138, wherein the cardioversion/defibrillation energy is approximately 60 to approximately 85 joules.

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145. The method of claim 128, wherein the energy source system comprises at least one battery cell(s).

5 146. The method of claim 145, wherein the at least one battery cell(s) comprise LiSVO battery cell(s).

10 147. The method of claim 129, wherein the energy storage system has an effective capacitance of approximately 50 microfarads to approximately 200 microfarads.

15 148. The method of claim 147, wherein the energy storage system has an effective capacitance of approximately 70 microfarads.

149. The method of claim 147, wherein the energy storage system has an effective capacitance of approximately 100 microfarads.

20 150. The method of claim 127, wherein the implantable cardioverter-defibrillator is less than approximately 100 cubic centimeters in volume.

151. The method of claim 150, wherein the implantable cardioverter-defibrillator is less than approximately 50 cubic centimeters in volume.

5 152. The method of claim 127, wherein the cardioversion/defibrillation energy has a peak voltage of approximately 700 volts to approximately 3150 volts.

10 153. The method of claim 152, wherein the cardioversion/defibrillation energy has a peak voltage of approximately 700 volts to approximately 1050 volts.

15 154. The method of claim 152, wherein the cardioversion/defibrillation energy has a peak voltage of approximately 1050 volts to approximately 1400 volts.

20 155. The method of claim 152, wherein the cardioversion/defibrillation energy has a peak voltage of approximately 1400 volts to approximately 1750 volts.

156. The method of claim 152, wherein the cardioversion/defibrillation energy has a peak voltage of approximately 1750 volts to approximately 2100 volts.

157. The method of claim 152, wherein the cardioversion/defibrillation energy has a peak voltage of approximately 2100 volts to approximately 2450 volts.

5 158. The method of claim 152, wherein the cardioversion/defibrillation energy has a peak voltage of approximately 2450 volts to approximately 2800 volts.

10 159. The method of claim 152, wherein the cardioversion/defibrillation energy has a peak voltage of approximately 2800 volts to approximately 3150 volts.

15 160. A power supply for an implantable cardioverter-defibrillator for subcutaneous positioning outside the ribcage and between the third rib and the twelfth rib within a patient and using a lead system that does not directly contact the patient's heart or resided in the intrathorasic blood vessels, and for providing cardioversion/defibrillation energy to the heart, the method comprising:

20 means for storing the cardioversion/defibrillation energy and delivering the cardioversion/defibrillation energy to the patient's heart;

means for providing cardioversion/defibrillation energy to the means for storing the cardioversion/defibrillation energy.

5 161. The power supply of claim 160, wherein the means for providing cardioversion/defibrillation energy comprises two or more battery cells.

10 162. The power supply of claim 161, wherein the means for providing cardioversion/defibrillation energy comprises three or more battery cells.

15 163. The power supply of claim 162, wherein the means for providing cardioversion/defibrillation energy comprises four or more battery cells.

20 164. The power supply of claim 163, wherein the means for storing the cardioversion/defibrillation energy comprises two or more capacitors.

165. The power supply of claim 164, wherein the means for storing the cardioversion/defibrillation energy comprises three or more capacitors.

166. The power supply of claim 165, wherein the means for storing the cardioversion/defibrillation energy comprises four or more capacitors.

5 167. The power supply of claim 166, wherein the means for storing the cardioversion/defibrillation energy comprises five or more capacitors.

10 168. The power supply of claim 167, wherein the means for storing the cardioversion/defibrillation energy comprises six or more capacitors.

15 169. The power supply of claim 160, wherein the cardioversion/defibrillation energy is approximately 40 to approximately 210 joules.

20 170. The power supply of claim 169, wherein the cardioversion/defibrillation energy is approximately 40 to approximately 60 joules.

171. The power supply of claim 169, wherein the cardioversion/defibrillation energy is approximately 60 to approximately 85 joules.

172. The power supply of claim 169, wherein the cardioversion/defibrillation energy is approximately 85 to approximately 115 joules.

5 173. The power supply of claim 169, wherein the cardioversion/defibrillation energy of approximately 115 to approximately 140 joules.

10 174. The power supply of claim 169, wherein the cardioversion/defibrillation energy is approximately 140 to approximately 160 joules.

15 175. The power supply of claim 169, wherein the cardioversion/defibrillation energy is approximately 160 to approximately 210 joules.

20 176. The power supply of claim 160, wherein the means for providing cardioversion/defibrillation energy comprises at least one battery cell(s).

177. The power supply of claim 176, wherein the at least one battery cell(s) comprise LiSVO battery cell(s).

178. The power supply of claim 160, wherein the means for storing the cardioversion/defibrillation energy has an effective capacitance of approximately 50 microfarads to approximately 200 microfarads.

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179. The power supply of claim 178, wherein the means for storing the cardioversion/defibrillation energy has an effective capacitance of approximately 70 microfarads.

10 180. The power supply of claim 178, wherein the means for storing the cardioversion/defibrillation energy has an effective capacitance of approximately 100 microfarads.

15 181. The power supply of claim 160, wherein the implantable cardioverter-defibrillator is less than approximately 100 cubic centimeters in volume.

20 182. The power supply of claim 181, wherein the implantable cardioverter-defibrillator is less than approximately 50 cubic centimeters in volume.

183. The power supply of claim 161, wherein the cardioversion/defibrillation energy has a peak voltage of approximately 700 volts to approximately 3150 volts.

184. The power supply of claim 184, wherein the cardioversion/defibrillation energy has a peak voltage of approximately 700 volts to approximately 1050 volts.

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185. The power supply of claim 184, wherein the cardioversion/defibrillation energy has a peak voltage of approximately 1050 volts to approximately 1400 volts.

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186. The power supply of claim 184, wherein the cardioversion/defibrillation energy has a peak voltage of approximately 1400 volts to approximately 1750 volts.

187. The power supply of claim 184, wherein the cardioversion/defibrillation energy has a peak voltage of approximately 1750 volts to approximately 2100 volts.

188. The power supply of claim 184, wherein the cardioversion/defibrillation energy has a peak voltage of approximately 2100 volts to approximately 2450 volts.

189. The power supply of claim 184, wherein the cardioversion/defibrillation energy has a peak voltage of approximately 2450 volts to approximately 2800 volts.

190. The power supply of claim 184, wherein the cardioversion/defibrillation energy has a peak voltage of approximately 2800 volts to approximately 3150 volts.

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